Technology Opportunity

Measurement Using Robust Liquid-Crystal Interferometer

The National Aeronautics and Space Administration (NASA) seeks to transfer a new liquid-crystal interferometer which has been proven to measure optical wavefronts. These measurements permit the determination of temperature, density, chemical composition, or thickness distributions in transparent solids, gases or liquids. This device can also be used to measure the shape of highly reflective objects such as mirrors.

Potential Commercial Uses

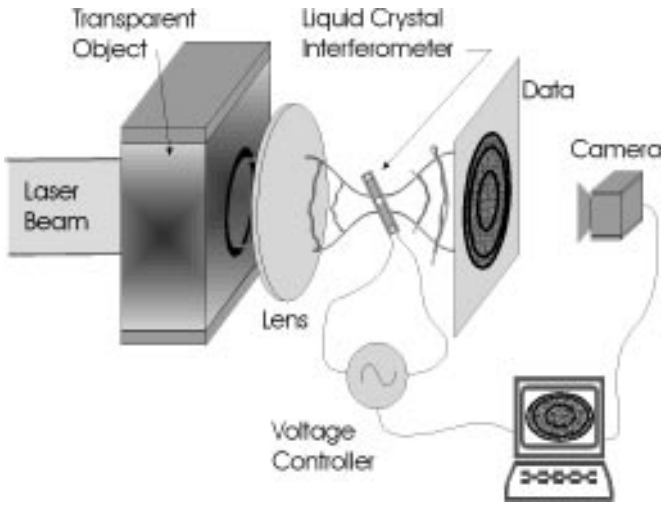
- Glass or plastic inspection
- Optical testing
- Remote temperature measurement
- Chemical mixing measurement
- Fluids studies

Benefits

- Relatively insensitive to vibrations and thermal disturbances
- Low cost, low weight, and small volume
- Full field measurement — measure a million points at once
- Automated data reduction

The Technology

A liquid-crystal interferometer has been invented for the measurement of transparent objects. The instrument has a compact, robust design and optical phase-stepping capability for quantitative data analysis. The result is a compact, simple to align, environmentally insensitive interferometer capable of accurately measuring optical wavefronts. This



Components required for making measurements with the liquid-crystal interferometer.

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instrument is at least two orders of magnitude less sensitive to vibration than conventional interferometers. The interferometer is constructed from a liquid-crystal layer that provides object-beam phase control, and an embedded microsphere that locally generates a reference beam.

This instrument can measure either transparent objects like fluids and lenses, or highly reflective objects like mirrors. In the former case, the refractive index distribution is measured and then related to various properties like temperature, density, chemical composition, or thickness. In the latter case, the measured phase distribution is related to the object shape. The objects measured must be stationary or quasi-steady state because several frames of image data must be acquired while the object's properties remain unchanged. The data-acquisition time depends on the speed of the frame grabber and the required number of data frames. Typically, three to five frames (1 to 2 sec total) are required, and the data-acquisition times may decrease.

Options for Commercialization

One of NASA's missions is to commercialize its technology. NASA Lewis' aim is to commercialize the liquid-crystal interferometer described herein. To encourage commercialization, the Lewis Commercial Technology Office will actively work with interested industrial partners in joint efforts to test and evaluate the liquid-crystal interferometer for industrial applications. Any company wishing to license this technology may do so provided it has a sound business plan with a high potential for success. A patent was applied for in June of 1995.

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Key Words

Optical phase measurement
Wavefront measurement
Temperature measurement
Density measurement
Optical testing

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